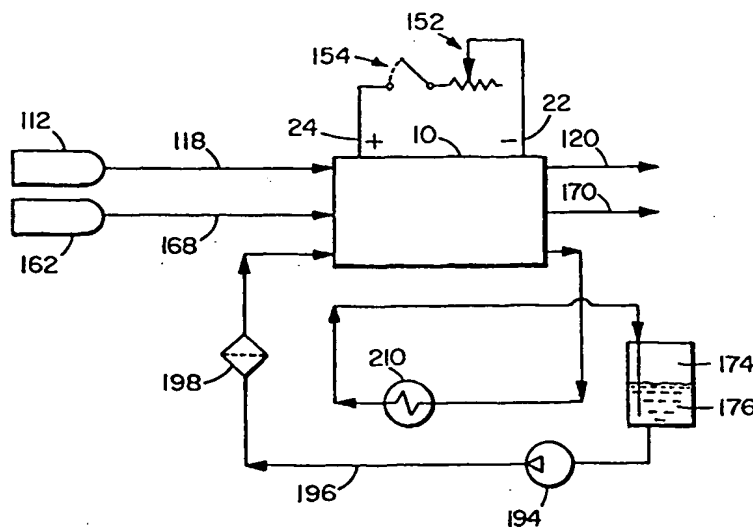




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<b>(21) International Application Number:</b> PCT/CA99/00850 <b>(22) International Filing Date:</b> 17 September 1999 (17.09.99)  <b>(30) Priority Data:</b> 198 43 401.4      22 September 1998 (22.09.98)    DE 2,247,856        23 September 1998 (23.09.98)        CA  <b>(71) Applicants (for all designated States except US):</b> BALLARD POWER SYSTEMS INC. [CA/CA]; 9000 Glenlyon Parkway, Burnaby, British Columbia V5J 5J9 (CA). DBB FUEL CELL ENGINES GMBH [DE/DE]; Neuestrasse 95, Nabern, D-73230 Kirchheim (DE).  <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> ST-PIERRE, Jean [CA/CA]; 2-2225 West 39th Avenue, Vancouver, British Columbia V6M 1T8 (CA). CAMPBELL, Stephen, A. [GB/CA]; 11323 261st Street, Maple Ridge, British Columbia V2W 1H2 (CA). WATSON, Mark, K. [CA/CA]; 20276 - 93B Avenue, Langley, British Columbia V1M 1Y7 (CA). SEXSMITH, Michael, P. [CA/CA]; 3677 Baird Road, North Vancouver, British Columbia V7K 2H3 (CA). DERFLINGER, Monika [DE/DE]; Kirchstrasse 60/1, D-73272 Neidlingen (DE). HORNBERG, Gerald [DE/DE]; Gansackerweg 155, D-89275 Elchingen (DE).		<b>(74) Agent:</b> DE KOCK, Elbie, R.; Russell Reyneke, Two Bentall Centre, Suite 700, 555 Burrard Street, Vancouver, British Columbia V7X 1M8 (CA).  <b>(81) Designated States:</b> AU, CA, DE, GB, JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: ANTIFREEZE COOLING SUBSYSTEM



## (57) Abstract

Liquid cooled systems having coolant circulation loops (136) must often operate in below freezing conditions. For instance, in various applications certain fuel cell systems (10) must be able to tolerate repeated shutdown and storage in below freezing conditions. Conventional glycol-based coolants typically used for internal combustion engines are generally unsuitable for use in the associated fuel cell cooling subsystems due to the presence of additives and/or inhibitors which are normally included to deal with problems relating to decomposition of the glycol. With additives or inhibitors present, the coolant conductivity can be sufficiently high as to result in electrical shorting or corrosion problems. However, provided the purity of the coolant is maintained, a pure glycol and water coolant mixture may be used as a fuel cell system coolant to obtain suitable antifreeze protection. Adequate purity can be maintained by including an ion exchange resin unit (158) in the cooling subsystem.

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